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A minimalist approach to comparative psychology

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Recently, two alternative approaches to comparative psychology were proposed in *Trends in Cognitive Sciences* [1,2]. The two approaches have in common their suggestion that complex cognitive mechanisms consist of simpler elements that are similar for humans and other animals. We very much welcome the suggestion that researchers should concentrate on underlying mechanisms [1] by conducting carefully designed empirical research [2]. However, de Waal and Ferrari's 'bottom-up perspective' [1] is an attempt to support the idea of cognitive continuity between human and non-human primates based on a limited interpretation of evolutionary theory, where Darwin's idea of common descent is all-important. The many striking examples of cognitive discontinuity [3] are then explained by assuming that these capacities are based on a 'deep homology' of 'the basic building blocks of cognition' (such as homologous brain regions in birds and mammals) and that this justifies anthropomorphism. By contrast, Shettleworth [2] emphasizes evolutionary convergence as an important factor. We concur with this view [3] and are puzzled by De Waal and Ferrari's suggestion [1] that Bolhuis and Wynne [3] considered convergence 'antithetical to evolutionary theory'; it is of course an integral part of it. Shettleworth [2] argues that the bottom-up approach reveals both similarities and differences between species, and this is indeed shown particularly clearly in language acquisition in humans and its animal parallels. Bolhuis *et al.* [4] concluded that, in the evolution of vocal imitation, which occurs in human speech and birdsong but is absent in apes [3,4], both common descent (homologous brain regions) and evolutionary convergence (similar auditory–vocal learning in birds and humans) have a role and that, even though songs of birds have a simple form of 'phonological syntax', they do not reach the complexity of human language [4]. Given that evolutionary relatedness is not a good predictor of the occurrence of vocal imitation in different taxa [3,4], and completely inadequate when it comes to language [4], Bolhuis and Wynne [3] concluded that 'evolution cannot explain how minds work'.

Shettleworth [2] argues that animal behaviour of seemingly 'human-like' cognitive complexity might well be more straightforward. Here, we advocate a specific method for this purpose: the self-organization approach (Box 1). Models of self-organization show that simple behavioural rules can lead to complex behaviour [5,6]. Such an approach integrates social behaviour with the effects of non-random encounter owing to the spatial structure of a group that develops as a consequence of the competitive regime. The spatial structure causes individual differences in who encounters whom. These differences in opportunities to interact with certain others (e.g. of high rank) lead to individual differences in social behavior that can easily be mistaken for cognitive intentions [6].

In conclusion, we advocate a minimalist approach to comparative psychology, where empirical studies of social behaviour should, among other things, first investigate causes and consequences of non-random proximity, before jumping to anthropomorphic conclusions.

Box 1. Minimal models of social behaviour

Models of self-organization show that cognitively simple explanations can be generated for several phenomena, including cultural traditions [7] and the caching and recovery behaviour of corvids [8]. To take one example, the phenomenon that two primate opponents groom after a fight earlier than they do otherwise has been called 'reconciliation' [9]. 'Reconciliation' occurs more frequently with more 'valuable' partners and in egalitarian societies more than in despotic ones, and is supposed to reflect memory of the fight, an understanding of the quality of relationships and a 'conciliatory' tendency [9]. Yet in our model [6], the whole spectrum of these patterns of 'reconciliation' also emerges, despite the lack of such cognitive rules. They emerge from the interplay between spatial structure and social behaviour, partly because former opponents are automatically in closer proximity after a fight than they are otherwise and, therefore, have more opportunities to groom each other. Indeed, in the few empirical studies that calculated the effect of omitting increased proximity after a fight, the conciliatory tendency was reduced drastically (e.g. [10]).

Many other behavioural patterns that resemble empirical data emerge in this model. For instance, the model predicted that, in primates, fiercer aggression and a higher percentage of males in the group should be accompanied by stronger dominance of females relative to males. This was confirmed in subsequent analysis of empirical data [11].

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Letters

Self and brain: what is self-related processing?

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Christoff *et al.* focus specifically on the subjective side of the self and associate it with sensorimotor and homeostatic functions [1]. This raises several issues concerning the nature of the neuronal processes associated with self-related processing and how to best approach the brain and define the concept of subjectivity.

Christoff *et al.* argue that self-related processing describes 'processing requiring one to evaluate or judge some feature in relation to one's perceptual image or mental concept of oneself'. Such cognitive definition of the self can account only for the objective self, the 'Me', and neglects the subjective self, the 'I'. The subjective self is characterized by self-specifying processing as related to sensorimotor and homeostatic functions, which allows for the basic self versus non-self distinction.

What is self-related processing and how does it relate to the brain? Most studies presuppose a rather cognitive concept of the self when using self-reflective tasks. This requires cognitive functions and what we have called 'self-referential processing' [2,3], by means of which a person

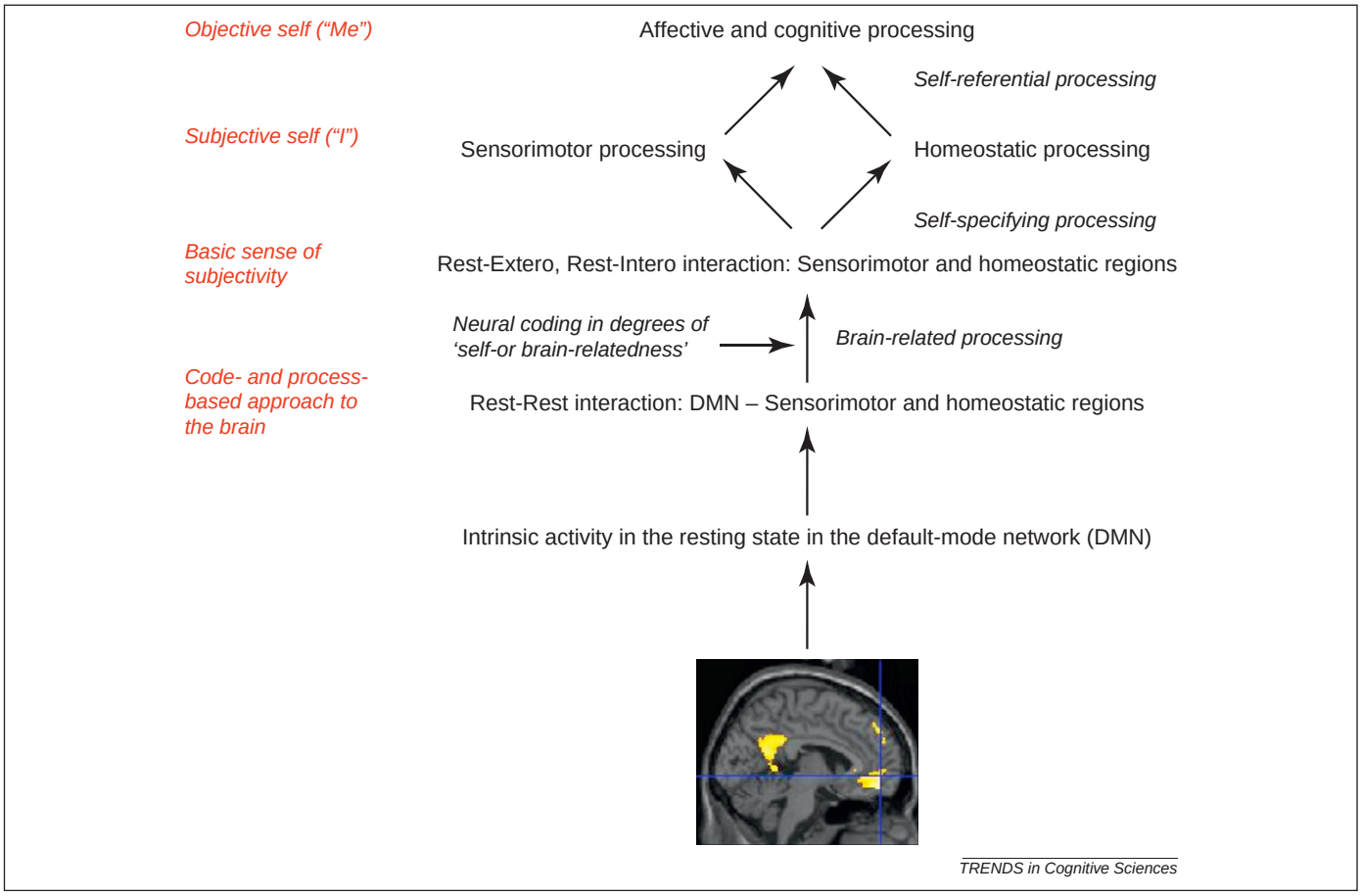

Figure 1. The intrinsic activity of the brain, neural coding, subjectivity and the self.

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